
User's Manual

Model TUS400G Ultrasonic Oscillator

IM 19C1B4-01E

vigilantplant.[®]

◆ INTRODUCTION

This user's manual describes instructions for handling of the TUS400G ultrasonic oscillator, including procedures for installation, operation, inspection and maintenance. Also, information necessary for you to further understand the product is described as required.

For handling of an ultrasonic vibrator for use together with this apparatus, refer to the user's manual attached to the instrument with the ultrasonic vibrator built in.

Model	Title	IM No.
TB750G	Right Angle Scatterde Kight TUrbidimeter	IM 12E01A06-01E

In continuous turbidity measurement, pollutive components sticking to the sensor of a turbidity meter is one of the causes of inaccurate measuring results. Therefore, cleaning of the sensor is an indispensable maintenance item for a lot of turbidity meters.

Ultrasonic cleaning is one of methods for cleaning sensors. The major strong point of ultrasonic cleaning is that you can continuously perform it while making measurement. Ultrasonic cleaning has cleaning effect on most of pollutive components.

The TUS400G ultrasonic oscillator is an apparatus for supplying an ultrasonic vibrator, built in a turbidity detector, with high-frequency energy.

Below is the description of what you should do before use of the apparatus and what you should understand before reading this instruction manual.

Specification Check

Unpack your ultrasonic oscillator with care, and check for any damage that may be caused during transport.

The TUS400G ultrasonic oscillator is fabricated to the customer specifications. For precautionary purposes, check to see that your ultrasonic oscillator is in accordance with your specifications, and that there is no missing accessory. Use the model codes indicated on the nameplate to check the specifications of your ultrasonic oscillators. For the meaning of the model codes, refer to Section 1.2.

Location of Nameplate: Panel inside apparatus.

US OSCILLATOR	
MODEL	TUS400G
SUFFIX	-NN-NN-1-L1-J
SUPPLY	100 V AC
	50/60 Hz
STYLE	
NO.	

Example on Indication of Nameplate

Precautions Which Must Be Taken when Actuating TUS400G Ultrasonic Oscillator during Inspection



NOTE

When actuating the TUS400G ultrasonic oscillator, be sure to connect the ultrasonic vibrator (under load, that is, immersed in fluid) as under normal operating conditions. Operating the ultrasonic oscillator solely (or, with the ultrasonic vibrator under no load connected) may cause some electric parts to be abnormally heated. This is unfavorable in terms of the life of the ultrasonic oscillator.

◆ For the safe use of this equipment

■ Safety, Protection, and Modification of the Product

- In order to protect the system controlled by the product and the product itself and ensure safe operation, observe the safety precautions described in this user's manual. We assume no liability for safety if users fail to observe these instructions when operating the product.
- If this instrument is used in a manner not specified in this user's manual, the protection provided by this instrument may be impaired.
- Be sure to use the spare parts approved by Yokogawa Electric Corporation (hereafter simply referred to as YOKOGAWA) when replacing parts or consumables.
- Modification of the product is strictly prohibited.
- The following symbols are used in the product and user's manual to indicate that there are precautions for safety:

■ Notes on Handling User's Manuals

- Please hand over the user's manuals to your end users so that they can keep the user's manuals on hand for convenient reference.
- Please read the information thoroughly before using the product.
- The purpose of these user's manuals is not to warrant that the product is well suited to any particular purpose but rather to describe the functional details of the product.
- No part of the user's manuals may be transferred or reproduced without prior written consent from YOKOGAWA.
- YOKOGAWA reserves the right to make improvements in the user's manuals and product at any time, without notice or obligation.
- If you have any questions, or you find mistakes or omissions in the user's manuals, please contact our sales representative or your local distributor.

■ Warning and Disclaimer

The product is provided on an "as is" basis. YOKOGAWA shall have neither liability nor responsibility to any person or entity with respect to any direct or indirect loss or damage arising from using the product or any defect of the product that YOKOGAWA can not predict in advance.

■ Symbol Marks

Throughout this user's manual, you will find several different types of symbols are used to identify different sections of text. This section describes these icons.



WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.



IMPORTANT

Indicates that operating the hardware or software in this manner may damage it or lead to system failure.



NOTE

Draws attention to information essential for understanding the operation and features.

◆ After-sales Warranty

■ Do not modify the product.

■ During the warranty period, for repair under warranty consult the local sales representative or service office. Yokogawa will replace or repair any damaged parts. Before consulting for repair under warranty, provide us with the model name and serial number and a description of the problem. Any diagrams or data explaining the problem would also be appreciated.

- If we replace the product with a new one, we won't provide you with a repair report.
- Yokogawa warrants the product for the period stated in the pre-purchase quotation. Yokogawa shall conduct defined warranty service based on its standard. When the customer site is located outside of the service area, a fee for dispatching the maintenance engineer will be charged to the customer.

■ In the following cases, customer will be charged repair fee regardless of warranty period.

- Failure of components which are out of scope of warranty stated in instruction manual.
- Failure caused by usage of software, hardware or auxiliary equipment, which Yokogawa Electric did not supply.
- Failure due to improper or insufficient maintenance by user.
- Failure due to modification, misuse or outside-of-specifications operation which Yokogawa does not authorize.
- Failure due to power supply (voltage, frequency) being outside specifications or abnormal.
- Failure caused by any usage out of scope of recommended usage.
- Any damage from fire, earthquake, storms and floods, lightning, disturbances, riots, warfare, radiation and other natural changes.

■ Yokogawa does not warrant conformance with the specific application at the user site. Yokogawa will not bear direct/indirect responsibility for damage due to a specific application.

■ Yokogawa Electric will not bear responsibility when the user configures the product into systems or resells the product.

■ Maintenance service and supplying repair parts will be covered for five years after the production ends. For repair for this product, please contact the nearest sales office described in this instruction manual.

Model TUS400G

Ultrasonic Oscillator

IM 19C1B4-01E 6th Edition

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1. Overview

The TUS400G ultrasonic oscillator is an apparatus that composes an ultrasonic cleaner together with an ultrasonic piezoelectric transducer (vibrator). The TUS400G supplies the ultrasonic vibrator with operating power via a cable.

The ultrasonic vibrator to be combined with the TUS400G is a vibrator mode of lead zirconate-titanate-based piezoelectric ceramics.

The ultrasonic vibrator is built in the turbidity detector.

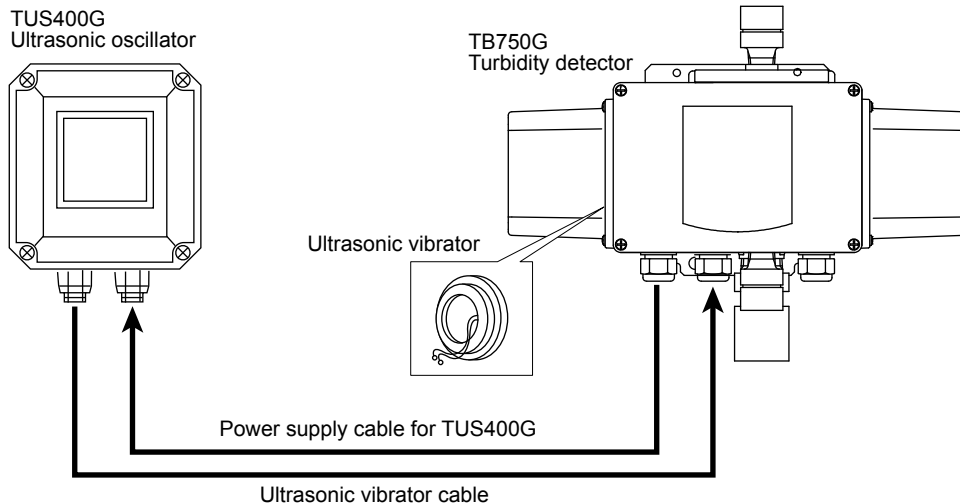


Figure 1.1 Configuration of Ultrasonic Cleaner Using TUS400G Ultrasonic Oscillator

This chapter gives the description of the specifications for the TUS400G ultrasonic oscillator.

1.1 Standard Specifications

Combination device:	Turbidimeter (TB750G) Special cable (3-conductor shielded cable)
Cleaning method:	Continuous ultrasonic emission (Frequency sweep method)
Oscillation frequency:	Approx. 170 to 200 kHz (sweeping frequency: Approx. 160 to 250 kHz)
Output voltage:	Approx. 40 to 80 V

Note: 1. Output of ultrasonic oscillator changes with power supply voltage. The output is lower when the voltage is lower.

2. Output of ultrasonic oscillator changes with connected cable. The output is lower when the length of the cable is longer.

Power supply:	100/110/115/200/220/240 V AC $\pm$ 10% 50/60 Hz
Power consumption:	Approx. 30 VA
Insulation resistance:	Power supply-G: 100 M Ω or more / 500 V DC Output terminals-G: 100 M Ω or more / 500 V DC
Withstand voltage:	Power supply-G: 1000/1500 V AC for 1 min. Output terminals-C: 1000/1500 V AC for 1 min.
Ambient Temperature:	-10 to 50°C (hood may be fitting as option)
Storage Temperature:	-25 to 70°C
Construction:	JIS C0920 Watertight (NEMA 4 equivalent waterproof construction)
Material:	Case; Aluminum alloy casting Window; Polycarbonate
Finish:	Baked polyurethane resin (Standard) Baked epoxy resin (Option)

Color:	Case; Frosty white (Munsell 2.5Y8.4/1.2 or equivalent) Cover; Deep sea-moss green (Munsell 0.6GY3.1/2.0 equivalent)
Mounting:	Pipe mounting, wall or rack mounting or panel mounting
Mounting material:	Stainless steel
Cable inlet port:	Ø22.7 hole x 2 DIN Pg16 watertight plastic gland
Cable/terminal:	For 7 to 12 mm, M4 screw
Conduit adapter:	Power supply side (optional)
Material:	Polycarbonate resin
Connection:	G1/2 or 1/2NPT
Weight:	Body: Approx. 2.0 kg Mounting: Approx. 0.7 kg
Dimension:	162W x 180H x 115D mm
Noise filter assembly:	(for TUS400G-NN-RC, TUS400G-NN-KC)
Ambient temperature:	-10 to 50°C (no dew condensation allowed)
Storage temperature:	-25 to 70°C
Construction:	JIS C 0920 Watertight (IP53)

Regulatory Compliance

(for TUS400G-NN-RC)

EMC Regulatory Arrangement in Australia and New Zealand

EN 55011 Class A, Group 1

(for TUS400G-NN-KC)

Korea Electromagnetic Conformity Standard Class A

한국 전자파적합성 기준

A급 기기 (업무용 방송통신기자재)

이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

1.2 Model and Suffix Codes

Model	Suffix Code	Option Code	Description
TUS400G			Ultrasonic oscillator for turbidimeter
—	-NN		Always -NN
Application	-NN -RC -KC		General Australia, for Oceania areas For Korea
Supply voltage *2	-1 -2 -3 -4 -5 -6		100 V AC, 50/60 Hz 110 V AC, 50/60 Hz 115 V AC, 50/60 Hz 200 V AC, 50/60 Hz 220 V AC, 50/60 Hz 240 V AC, 50/60 Hz
Ultrasonic vibrator connecting cable	-00 -L1 -L2 -L3 -L4 -05 -10 -15		None 1 m (for Model TB700G or TB750G) 5 m (for Model TB700G or TB750G) 10 m (for Model TB700G or TB750G) 15 m (for Model TB700G or TB750G) 5 m (for Model 8562) 10 m (for Model 8562) 15 m (for Model 8562)
Language for directions	-E -J		Japanese (Directions indicated on product: Some are written both in Japanese and in English.) English (Directions indicated on product: Some are written both in Japanese and in English.)
Option	Mounting hardware Hood Tag plate Special painting Adapter for conduit work Special screws	/PS /W /PA /H /SCT /X1 /AFTG /ANSI /SPS	Pipe mounting (SUS) Wall mounting (SUS) Panel mounting (SUS) Sunshade hood Stainless steel tag plate Epoxy painting G1/2 1/2NPT Teflon coated SUS steel screws (resistant to salt corrosion) *1

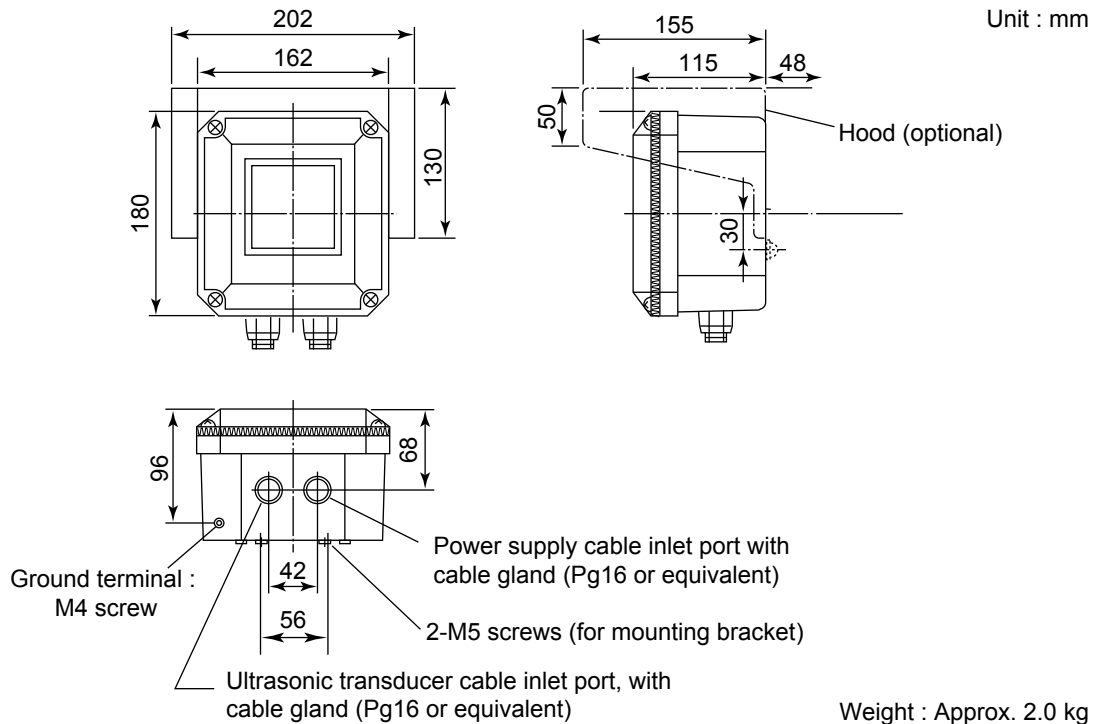
*1: The SUS screws with Teflon coating are used at the four corners of the cover.

*2: The power supply to TB700G or TB750G should be determined in accordance with the supply voltage specified here.

Accessories

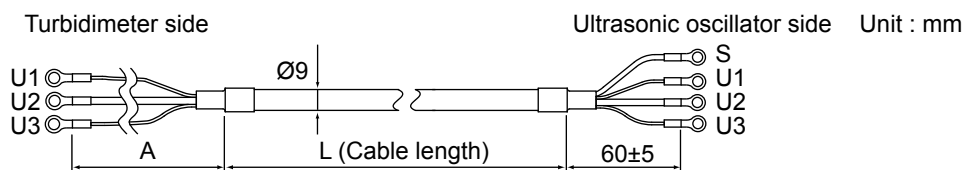
Part Name	Part Number	Remarks
Spare Fuse	K9317AZ	1 A : 1 pc, 2 A : 2 pcs

1.3 External Dimensions



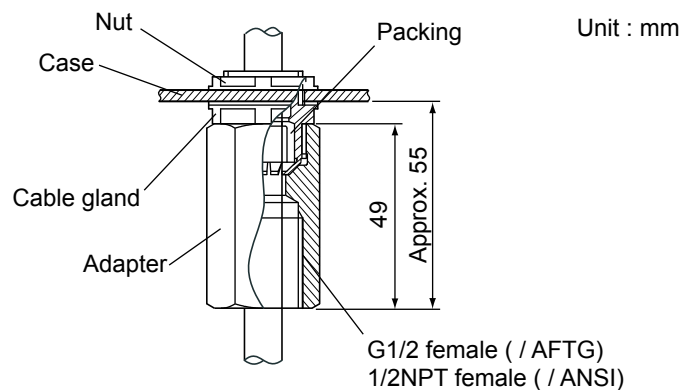
Ultrasonic Vibrator Connecting Cable

(Note) Not attached when suffix code "-00" is specified.



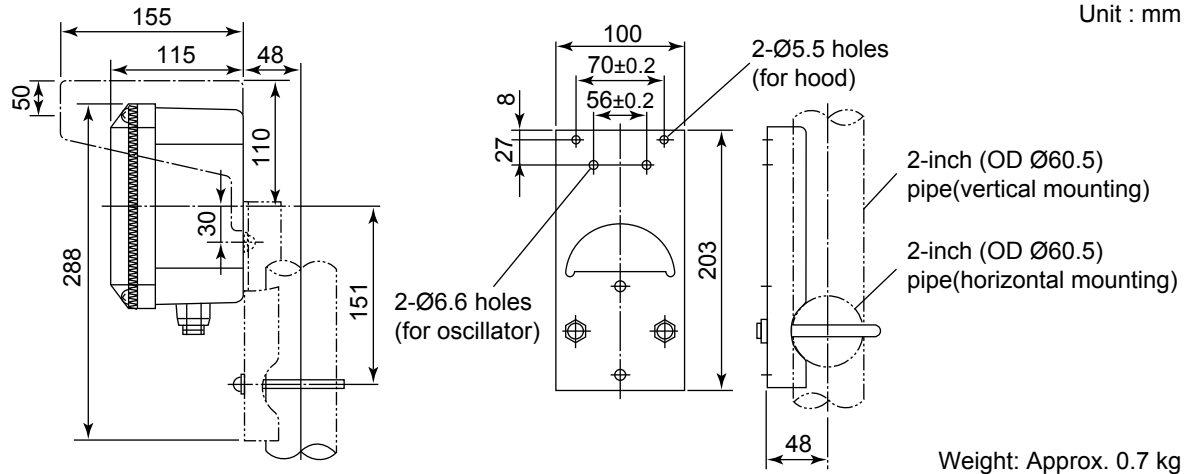
Model Code	L (Approx.)	A (Approx.)	Combination device
TUS400G - NN - NN - □ -L1 - □	1 m	180	TB750G or TB700G
TUS400G - NN - NN - □ -L2 - □	5 m		
TUS400G - NN - NN - □ -L3 - □	10 m		
TUS400G - NN - NN - □ -L4 - □	15 m		
TUS400G - NN - NN - □ -05 - □	5 m	80	8562
TUS400G - NN - NN - □ -10 - □	10 m		
TUS400G - NN - NN - □ -15 - □	15 m		

Conduit connecting adapter (option code: /AFTG, /ANSI)

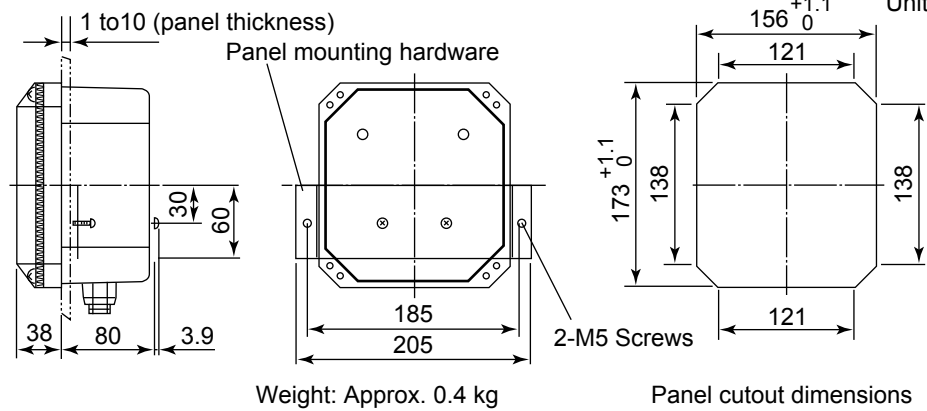


Pipe Mounting Bracket (option code: /PS)

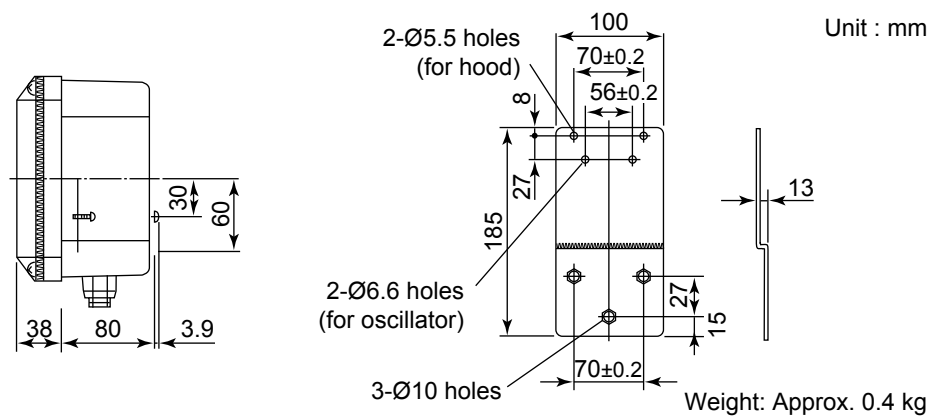
Unit : mm

**Panel Mounting Bracket (option code: /PA)**

Unit : mm

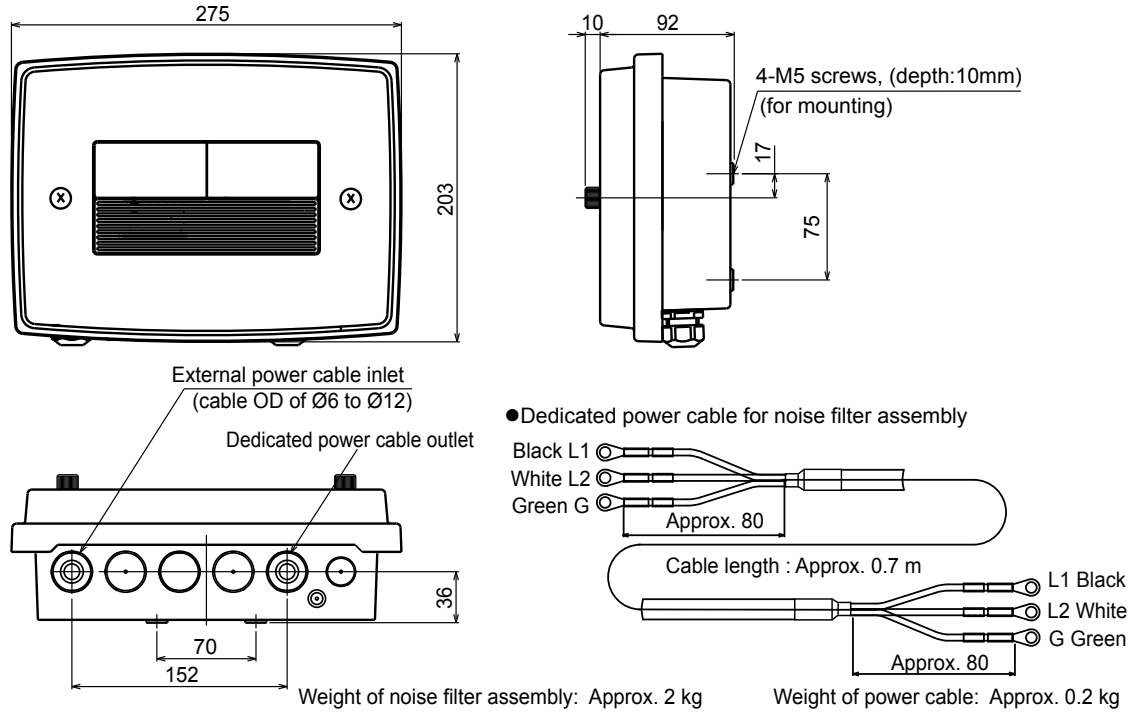
**Wall Mounting Bracket (option code: /W)**

Unit : mm



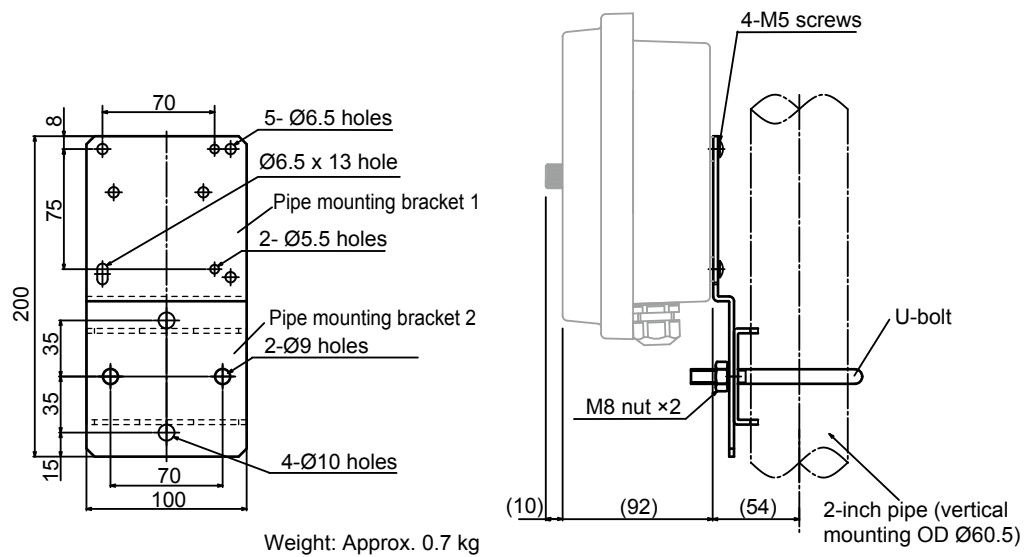
Noise filter assembly (for TUS400G-NN-RC, TUS400G-NN-KC)

Unit: mm

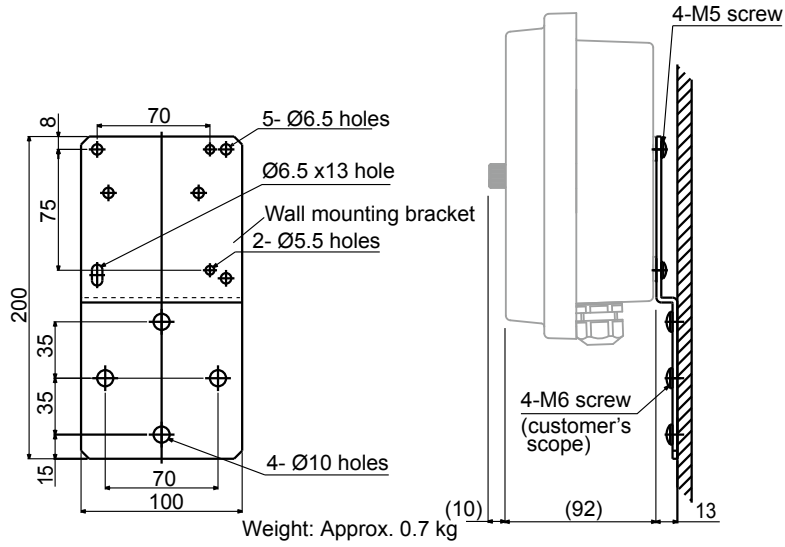


• Pipe Mounting Bracket for Noise filter assembly (option code: /PS)

Unit: mm



• **Wall or Panel Mounting Bracket for Noise filter assembly (option code: /W, /PA)** Unit: mm



2. Installation and Wiring

The TUS400G ultrasonic oscillator should be installed in a place where the power switch is easily turned ON/OFF and the “in-action” pilot lamp. Install the TUS400G as close to the turbidimeter as possible.

This chapter describes how to select an installation site and procedures for installation and wiring.

2.1 Installation

The TUS400G ultrasonic oscillator may be installed outdoors. However, it should be installed in as favorable an environment as possible in order to keep its electric circuits in good condition.

2.1.1 Installation Site

Install the TUS400G ultrasonic oscillator in a place where the following requirements are met:

- **The TUS400G must be installed as close to the location of the ultrasonic vibrator as possible.**

If a cable for connecting the ultrasonic oscillator and the ultrasonic vibrator is too long, an ultrasonic power required to obtain sufficient cleaning effect will not be obtained.

Make sure that the length of the cable does not excessively exceed 15 meters.

- **The TUS400G must be installed in a place free from corrosive gases.**

Corrosive gases damage the electric parts in the oscillator and should be avoided.

- **The TUS400G must be installed in a place with less fluctuation in temperature at ordinary temperature or a temperature close to ordinary temperature.**

The fluctuation in temperature at the installation site should be within the range of -10 to 50°C.

- **The TUS400G must be installed in a place where a humidity of 5 to 90% RH is maintained.**

Avoid installing the ultrasonic oscillator in a place where a high or low humidity is maintained for a long time. It is recommended to always operate the TUS400G at a humidity of 25 to 85% RH.

- **The TUS400G must be installed in a place not exposed to direct sunlight.**

Direct sunlight may excessively increase temperature in the oscillator. If there is any high temperature equipment nearby, temperature in the oscillator may be also excessively increased due to radiant heat. If temperature in the oscillator is likely to rise and exceed allowable limit due to direct sunlight, then install a sunshade hood (optional)

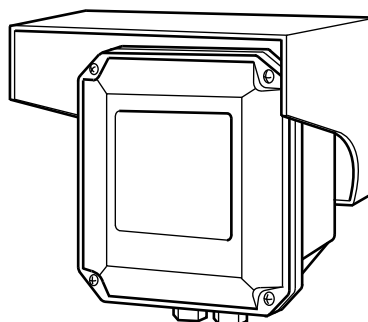


Figure 2.1 Sunshade as Installed

2.1.2 Installing Procedure

The ultrasonic oscillator may be mounted on panel, a wall surface or a pipe (2-inch, OD: 60.5 mm). Hardware corresponding to the type of mounting used is required to install the TUS400G. Mounting hardware is attached only when requested.

In the case of TUS400G-NN-RC or TUS400G-NN-KC, a noise filter assembly is attached. Please refer to a figure of external dimensions for the attachment means of the noise filter assembly.

(1) Panel Mounting

Figure 2.2 illustrates the installing procedure for the ultrasonic oscillator using panel mounting bracket.

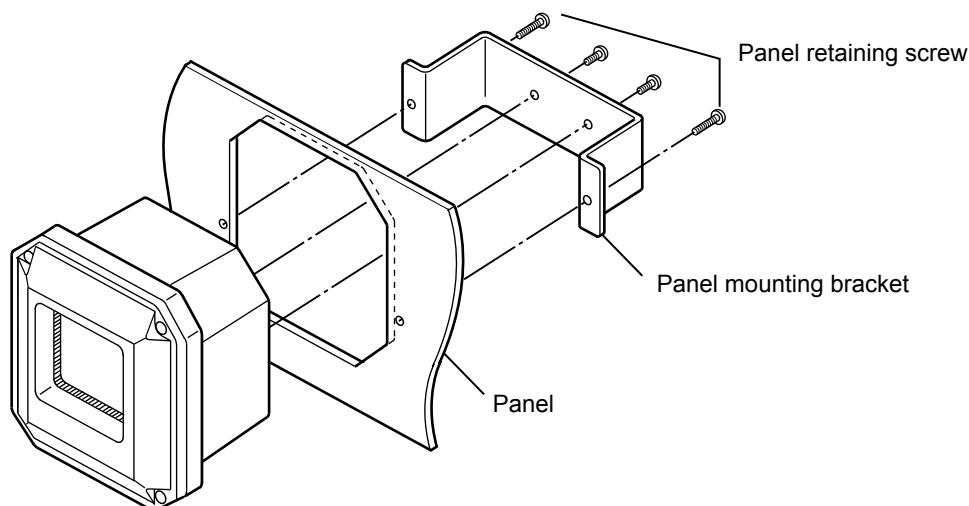


Figure 2.2 Mounting Method for Ultrasonic Oscillator Using Panel Mounting Bracket

To mount the TUS400G on a panel, cut out the panel in accordance with Figure 2.3.

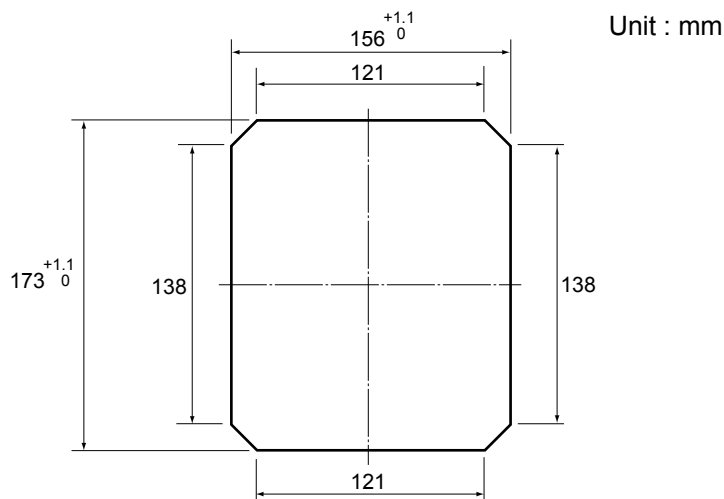


Figure 2.3 Panel Cutout Dimensions

(2) Pipe Mounting

When mounting the TUS400G on a pipe, install a pipe (2-inch, OD: 60.5 mm) in the vertical or horizontal direction.

Figure 2.4 illustrates the installing procedure for the ultrasonic oscillator using pipe mounting bracket.

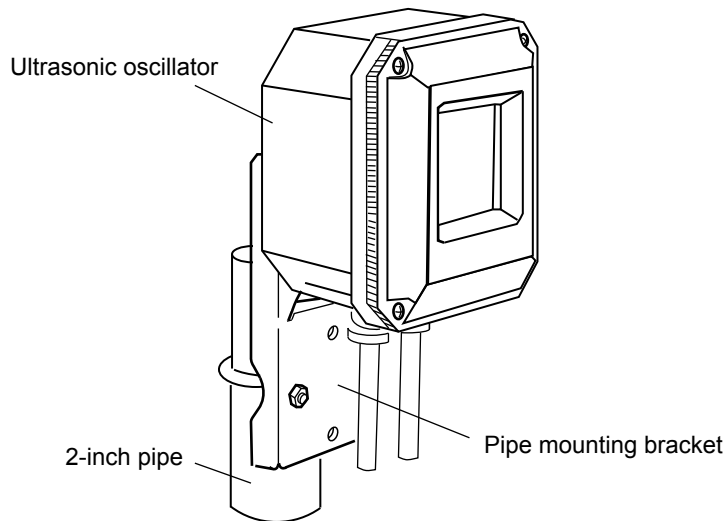


Figure 2.4 Ultrasonic Oscillator as Mounted on Pipe

(3) Wall Mounting

Figure 2.5 illustrates the installing procedure for the ultrasonic oscillator using wall mounting bracket.

Drill screw holes (for M8 screw, 3 places) in accordance with the figure below before mounting the TUS400G.

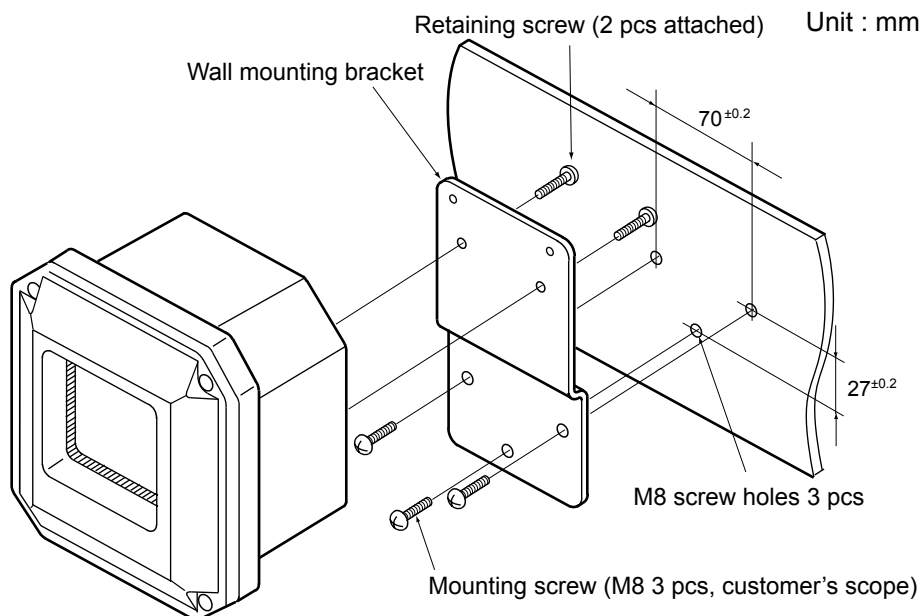


Figure 2.5 Hardware and Procedure for Wall Mounting

2.2 Wiring

This section describes types of wiring installed for the TUS400G ultrasonic oscillator and wiring work procedures type by type.

2.2.1 Types of Wiring

There are three types of wiring installed for the TUS400G ultrasonic oscillator. The ultrasonic vibrator cable (of a specified length) is attached only when requested.

- **Ultrasonic vibrator cable connection (power line for ultrasonic vibrator)**
- **Power supply wiring**
- **Grounding wiring**

Figure 2.6 illustrates the connecting terminals for these types of wiring.

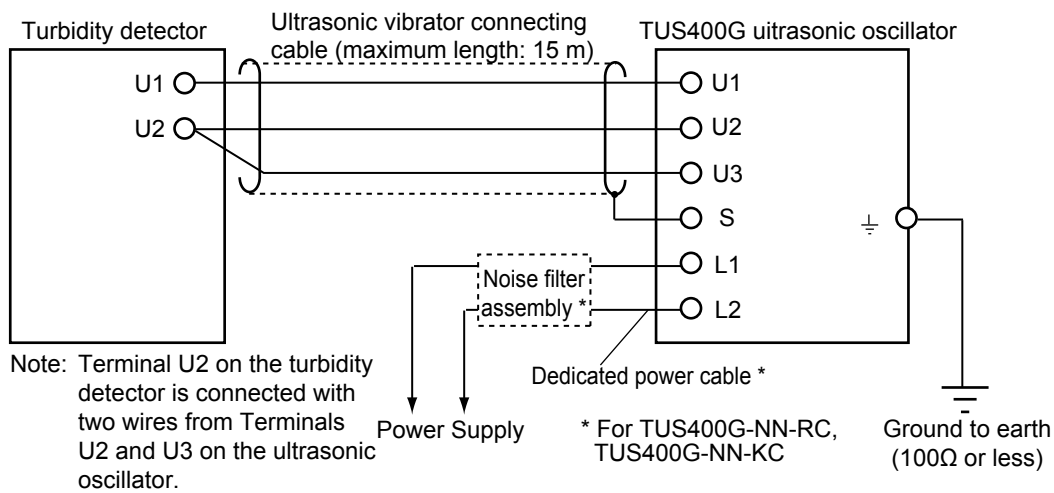


Figure 2.6 External Wiring Diagram

2.2.2 Cable Protection by Conduit

The power cable connected to the ultrasonic oscillator can be protected by conduits to prevent damage to its coating. In this case a dedicated cable gland with an adapter for conduit connection is required. The cable gland with an adapter is attached only when requested.

[Mounting Procedure for Cable Gland with Conduit Connecting Adapter]

Remove the cable gland (DIN Pg16 or equivalent) from the cable inlet in the ultrasonic oscillator, and install the attached cable gland (JIS 15A or equivalent) and the adapter for conduit connection, as shown in Figure 2.7.

Firmly tighten the gasket to prevent moisture from entering the oscillator through the cable inlet.

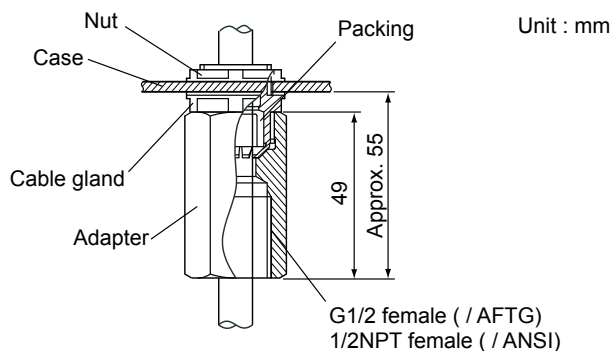


Figure 2.7 How to Install Adapter for Conduit Work

2.2.3 Connecting Ultrasonic Vibrator Cable

The ultrasonic vibrator connecting cable is used to install the power wiring for the ultrasonic piezoelectric transducer (vibrator), which connects between Terminals U1, U2 and U3 on the TUS400G ultrasonic oscillator and Terminals UI and U2 on the turbidity detector.

The ultrasonic vibrator connecting cable of a specified length (1 m, 5 m, 10 m or 15 m) is attached only when requested. If you fabricate an ultrasonic vibrator cable, then take the following points into account:

[Precautions in Fabricating Ultrasonic Vibrator Connecting Cable (Power Cable for Vibrator)]

- **Use a three-core shielded cable with an outside diameter of 7 to 12 millimeters.**
The length of the cable must be limited to 15 meters or below.
- **Be sure to allocate the shield on the cable to “S”.**

Figure 2.8 illustrates the dimensions of the terminations of the power cable for vibrator.

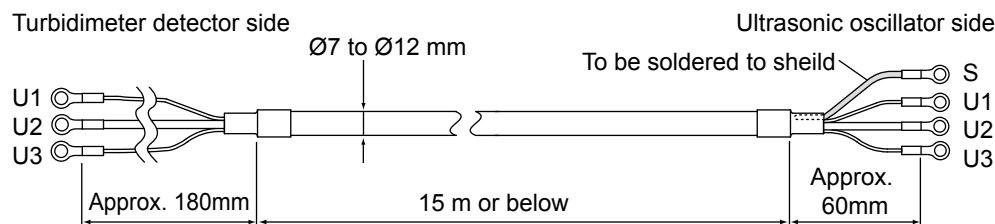


Figure 2.8 Cable Fabricating Procedure

2.2.4 Power Supply Wiring

Use a two-core cable with a conductor nominal cross-sectional area of 0.5 mm² or above for power supply wiring.

Connect the cable from a power supply having a specified voltage (voltage fluctuation: within a range of $\pm 10\%$ of nominal voltage) to Terminal L1 and L2 on the ultrasonic vibrator.

Note: If the supply voltage drops below the allowable range, the power of ultrasonic waves is weakened, which may result in the degradation in cleaning effect.

The screw size of the terminals is M4. Use a crimp contact conformable to the size for cable termination.

Place in the power supply wiring a switch for shutting off the power supply to the ultrasonic oscillator. With this switch provided, safety is ensured when the wires are removed from the ultrasonic oscillator for repair or the like. Use the power switch inside the TUS400G ultrasonic oscillator to start or stop it for or during steady state operation.

In the case of TUS400G-NN-RC or TUS400G-NN-KC, please wire a noise filter assembly by all means.

2.2.5 Ground Wiring

The TUS400G ultrasonic oscillator should be grounded to earth (grounding resistance: 100Ω or below). Use a conductor with a nominal cross-sectional area of 2 mm² or above. The grounding terminal is located on the left side at the lower part of the case (when viewed from front) (Refer to the external dimensions on Sec. 1.3.) The terminal uses a M4 screw.

3. Operation

The TUS400G Ultrasonic Oscillator should be actuated when the turbidimeter is operated (when measurement fluid is started to flow). This chapter describes preparations before starting operation and operating procedures.

3.1 Names and Function of Each Part

You can see the in-action pilot lamp through the window in the front cover. When you remove the front cover, you can find the power switch, fuses and so on.

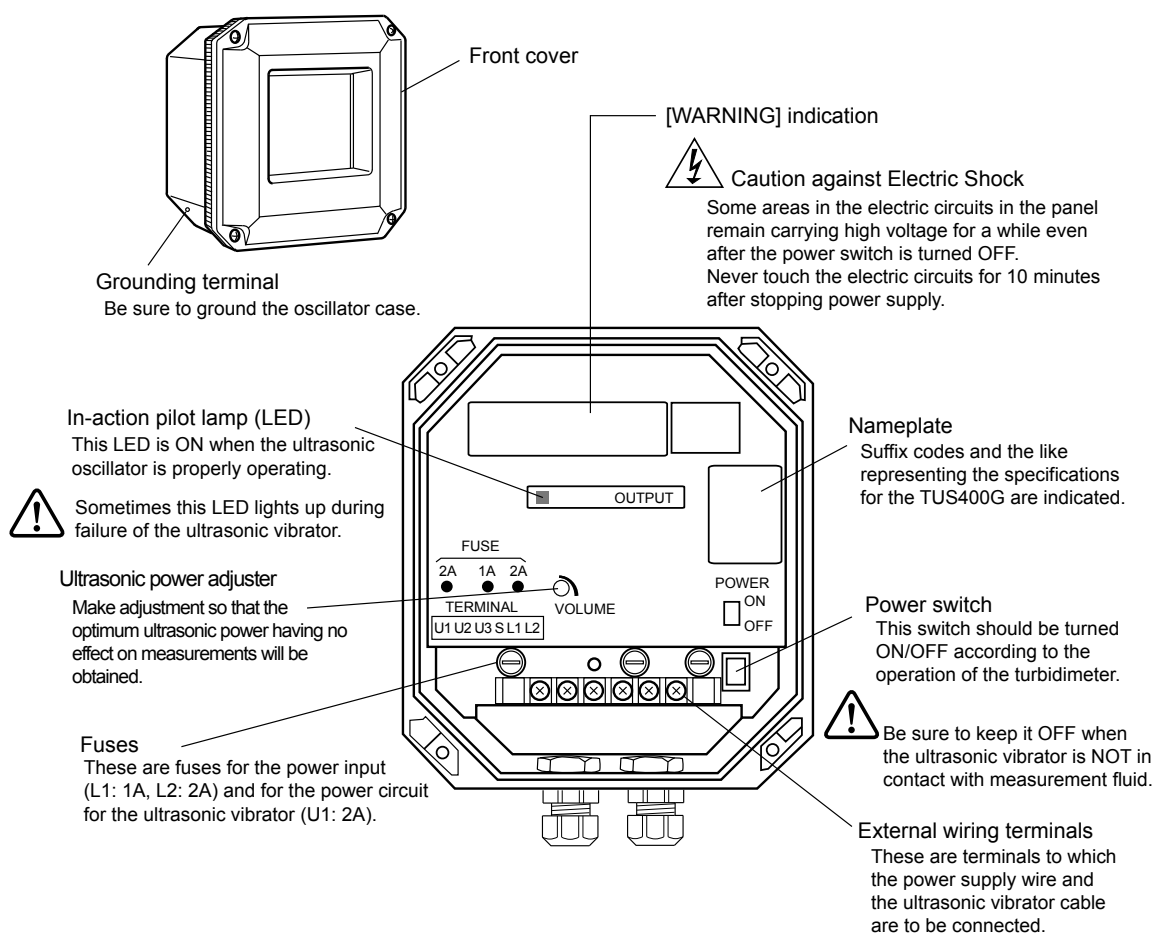


Figure 3.1 Names and Function of Each Part in TUS400G Ultrasonic Oscillator

3.2 Preparation for Operation

Inspect the state of wiring installation before starting the steady state operation of the TUS400G ultrasonic oscillator.

3.2.1 Inspecting State of Wiring Installation

Check to see that the wiring work has been properly executed to meet the following requirement:

- **The vibrator connecting cable must be properly connected to the right terminals on the ultrasonic oscillator and turbidity detector.**

The wires to be connected to Terminal U2 and U3 on the ultrasonic oscillator are connected together to Terminal U2 on the turbidity detector. The length of the cable must be 15 meters (approximately) or below.

Note: If an existing two-core shielded cable is used, then check to see that Terminal U2 and U3 on the ultrasonic oscillator are short-circuited to each other. The shield on the cable should be connected to Terminal "S".

- **A power supply of the specified voltage with voltage fluctuation within the allowable range must be available to Terminals L1 and L2 on the ultrasonic oscillator.**

For precautionary purposes, check to see that the fuses (three places) are firmly installed.



NOTE

With the ultrasonic vibrator unconnected, the in-action pilot lamp will not light up even if power is supplied. Do not operate the ultrasonic oscillator with the ultrasonic vibrator NOT in connect with fluid. Attention should be given especially when an existing two-core shielded cable is used. With the ultrasonic vibrator NOT in contact with fluid, some parts in the electric circuits are excessively heated to a temperature higher than in ordinary operation. This is unfavorable in terms of the life of the ultrasonic oscillator.

- **The ultrasonic oscillator must be grounded (grounding resistance: 100Ω or below.)**

3.2.2 Adjusting Ultrasonic Power

In ultrasonic cleaning, cavitation caused by the application of ultrasonic waves contributes to the cleaning effect. The more cavities are produced, the more the cleaning effect is enhanced. In turbidity measurement using an optical system, however, measured values are more largely influenced with increase in the number of cavities produced.

Therefore, the ultrasonic power must be adjusted so that the influence on measurements is controlled to within an allowable range and that the cleaning effect is maximized.

Use the VOLUME ultrasonic power adjuster located inside the ultrasonic oscillator to adjust the ultrasonic power. Take the following procedures in ultrasonic power adjustment:

Note: To make the adjustment, the turbidimeter must be ready for operation.

[Outline of Adjusting Operation]

Fill the measuring cell (detector's cell) in the turbidity detector with a measurement fluid. Operate the ultrasonic power adjuster until the difference becomes extinct (or falls within an allowable range) between the measured value when ultrasonic cleaning is NOT performed and that when it is under way.

Note: Allowable difference range should be set case by case according to desired measuring accuracy.

[Adjusting Procedure]

- (1) Fill the measuring cell in the turbidity detector with a measurement fluid at the same flow rate as in steady-state operation.

Note: Even if the ultrasonic power is the same, the influence of ultrasonic waves on measured values varies depending on the properties (velocity of flow and amount of suspended solids) of fluid in the measuring cell.

- (2) Actuate the turbidimeter and record the value of an output signal using a reception meter.

Note: The ultrasonic power adjuster should be operated while monitoring the record on the reception meter. If the ultrasonic oscillator is positioned far away from the turbidity meter, then place an apparatus equivalent to the turbidity meter close to the ultrasonic oscillator, and the adjusting operation is facilitated.

- (3) Turn the adjuster shaft of the ultrasonic power adjuster fully counterclockwise, and actuate the ultrasonic oscillator (turn ON the power switch inside the oscillator).

Note: When the in-action pilot lamp lights, it indicates that the ultrasonic oscillator is normally operating. The ultrasonic oscillator gets to the required operating state in 10 minutes or so.

- (4) Adjust the irradiation intensity of ultrasonic waves.

Carefully turn the adjusting shaft of the ultrasonic power adjuster clockwise to increase the irradiation intensity of ultrasonic waves while its influence on turbidity measurements is within the allowable range. After every 10-degree turn, check the value of the output signal. The influence of the ultrasonic waves can be checked with the record of the reception meter or the indications of the turbidity meter. After the adjustment is completed, turn off the power switch of the ultrasonic oscillator.

Note: In general, increasing the flow rate of the measurement liquid minimizes the influence on measurements while the intensity of ultrasound waves remains strong.

3.3 Steady State Operation

The ultrasonic oscillator should be operated only when the ultrasonic vibrator is in contact with fluid. If it is operated with the ultrasonic vibrator exposed to the air, or with no load (i.e. with the measuring cell empty), the temperature of the electric circuit parts excessively rises, which has harmful effect on the life of the ultrasonic oscillator. The TUS400G is provided with the function of stopping the power supply to the ultrasonic vibrator if the temperature of the electric circuit parts extraordinarily rises.

If it is verified at the start of operation that favorable cleaning operation is in progress, it is unnecessary for the operator to control the ultrasonic oscillator during the subsequent steady state operation. When inspecting the turbidimeter, however, check to see that the in-action pilot lamp is ON

3.3.1 Checking Influence of Ultrasonic Wave Application on Measured Turbidity Value

If the ultrasonic power is adjusted under conditions (properties of fluid and velocity of flow) different from those for steady state operation, check at the start of operation to see that the influence of that on the measured turbidity values is within the allowable range.

To do this, take the following procedures:

- (1) Bring the turbidimeter and the output signal receiver in the state of steady state operation. For the operating procedure for these apparatuses, refer to the respective instruction manuals.
- (2) Actuate the ultrasonic oscillator: Turn ON the power switch inside the oscillator, and check to see that the in-action pilot lamp is ON.
Further, check the glass window in the measuring cell in the turbidity detector for any sticking air bubble. If there is any sticking bubble, remove it referring to the instruction manual for the turbidimeter.
- (3) Allow the ultrasonic oscillator to operate for 10 minutes or so, and then turn OFF the power switch to stop the operation of the oscillator. Then examine change in output signal value.
If the change is within the allowable range, turn ON the power switch in the ultrasonic oscillator again to start steady state operation. If the change is out of the allowable range, operate the ultrasonic power adjuster in accordance with the procedures described in Subsection 3.2.2.

3.3.2 If In-Action Pilot Lamp Goes OFF (Related information: Section 4.2)

If the in-action pilot lamp goes off, the possible causes are:

- **A thermal protective element has been activated (extraordinary heating of electric circuit parts). [The oscillator case is giving off heat.]**
- **Any fuse in the oscillator has burnt out. [The oscillator case is NOT giving off heat.]**

[In Case Thermal Protective Element Has Been Activated]

The electric circuit parts extraordinarily heated have not completely dropped in temperature yet. Turn OFF the power switch located inside the ultrasonic oscillator first of all, and try to find the cause of the extraordinary heating. Do not turn ON the power switch again until the cause is removed.

The possible causes of extraordinary heating of the electric circuit parts are: (1) Supply of measurement fluid is stopped, and the measuring cell becomes empty, and (2) Some trouble has occurred in the ultrasonic vibrator.

If it turns out that the extraordinary heating was caused by the measuring cell becoming empty, take necessary measures to prevent the measuring cell from becoming empty during steady state operation.

If it is found that the cause of the extraordinary heating was any trouble in the ultrasonic vibrator, the ultrasonic oscillator requires repair or replacement with a good one.

Take necessary measures referring to "5. Troubleshooting" in this manual.

When the cause of extraordinary heating is removed and temperature falls to a certain level, the thermal protective element is automatically reset (switch: ON). This lights up the in-action pilot lamp.

[In Case Fuse Has Burnt Out]

Replace the burnt fuse with a new one. (Refer to Subsection 4.2.2.)

3.3.3 Stopping and Restarting Operation

For the prevention of trouble in the TUS400G ultrasonic oscillator and the ultrasonic vibrator, it is important to avoid operating it with no load (i.e. with the measuring cell empty). When performing maintenance work (zero point calibration, etc.) on the turbidimeter, turn OFF the power switch in the ultrasonic oscillator and then stop the supply of measurement fluid. To restart turbidity measuring operation, supply the measurement fluid and then turn ON the power switch in the ultrasonic oscillator

4. Inspection and Maintenance

This chapter describes routine inspection and maintenance work required to allow the TUS400G ultrasonic oscillator to fully deliver its performance and to obtain favorable cleaning results.

Refer to “5. Troubleshooting” in this manual for the improvements of the equipment preventing the achievement unfavorable cleaning effect and the remedies for troubles in the equipment.

4.1 Inspecting State of Ultrasonic Wave Application

If ultrasonic wave application does not have sufficient cleaning effect, it is impossible to accomplish the purpose of ultrasonic cleaning of maintaining accurate turbidity measurement for a long time. Check whether the ultrasonic oscillator is normally operating whenever errors in measurements have been excessive due to ultrasonic wave application.

4.1.1 Checking State of Ultrasonic Oscillator Operation

During turbidity measurement, check to see that the ultrasonic oscillator is satisfactorily operating as well. To do this, check whether the in-action pilot lamp inside the oscillator is ON.

If not, perform maintenance work in accordance with the instructions described in Section 4.2.

4.1.2 Checking Degree of Influence on Measured Value

Checks on the degree of the influence on the measured values are made mainly in the following cases:

- **When the flow rate (velocity of flow) of the measurement fluid largely departs from that at the time of ultrasonic power adjustment.**
- **After the ultrasonic vibrator is replaced.**

This inspection is performed by comparing the measured value when ultrasonic wave are applied with those when there is no application. The measured values should be read in accordance with the procedures described in Subsection 3.3.I.

If there is still large influence on the measured values after the adjustment of ultrasonic power, take other measures, such as increasing the flow rate of measurement fluid.

4.2 Inspection When In-Action Pilot Lamp is OFF

The in-action pilot lamp may be kept OFF by erroneous operation (e.g. forgetting to turn ON the power switch), or some trouble, such as anomalies in the wiring (disconnection and short circuit) and faults in the equipment.

If the cause is such trouble, cope with it referring to Chapter 5.

4.2.1 How to Find Cause of Pilot Lamp Going Out

Touch the case of the ultrasonic oscillator with your hand.

[In Case Ultrasonic Oscillator Case is Giving Off Heat]

Keep OFF the power switch in the oscillator until the cause is identified. If the case feels hot, the following are suspected to be the cause of the in-action pilot lamp going out:

- **The measuring cell in the turbidity detector has become empty (or was empty until just a few minute ago).**

Some of the electric parts in the ultrasonic oscillator extraordinarily increase in temperature if ultrasonic waves are applied from the ultrasonic vibrator with no load (with the measuring cell empty). This extraordinary temperature rise is detected by the thermal protective element, which then stops the power supply to the ultrasonic vibrator and turn OFF the in-action pilot lamp.

Check whether fluid is flowing in the measuring cell. Or, check the record of measured turbidity values for any sign that the measuring cell has become empty.

If it is revealed that the measuring cell in the turbidity detector became empty, for precautionary purposes, check whether there was any anomaly (e.g. cracking) in the fluid-contacting glass of the ultrasonic vibrator before the power supply to the vibrator is stopped (the thermal protective element is activated).

When the measuring cell is filled with fluid and the temperature in the ultrasonic oscillator falls to the specified level, the in-action pilot lamp automatically lights up, and the power supply to the ultrasonic vibrator is restarted. Turn ON the power-switch and wait for a while (at most 30 minutes) until the equipment is brought to such a state.

Note: If the measuring cell is spontaneously emptied of fluid during operation, it is required to improve the facilities (installed piping and so on).

- **The fuse has burnt out (in the power supply circuit for the ultrasonic vibrator).**

A 2A fuse is placed in the power circuit for the ultrasonic vibrator in the ultrasonic oscillator.

Turn OFF the power switch and check whether the fuse has burnt out. Refer to Subsection 4.2.2 for details.

- **The power cable for ultrasonic vibrator is disconnected or short-circuited.**

The in-action pilot lamp goes out for the same reason as the case where the measuring cell becomes empty.

First, check to see that the cable is connected to the terminals on the ultrasonic oscillator and turbidity detector with reliability. Next, check the cable for any disconnection or short circuit using a tester or the like.

If the cable turns out to be faulty, cope with it in the instructions described in Subsection 5.2.1 in Chapter 5.

- **There is a problem in the ultrasonic vibrator.**

If the pilot lamp going out is caused by neither of the three above-mentioned problems, the cause is often trouble in the ultrasonic vibrator.

Referring to Subsection 5.2.2 in Chapter 5 in this manual or the instruction manual for the turbidimeter, examine the power supply circuit for the piezoelectric transducer (ultrasonic vibrator) in the turbidimeter.

If the cause of the in-action pilot lamp going out cannot be identified even after checking all the above-mentioned items, contact YOKOGAWA.

[In Case Ultrasonic Oscillator is NOT Giving Off Heat]

If the case of the ultrasonic oscillator does not feel hot, the following are suspected to be the cause of the in-action pilot lamp going out.

Check to see that power is supplied to the ultrasonic oscillator and the power switch in the oscillator is ON:

- **Any of the fuses has burnt out.**

The ultrasonic oscillator has two fuses, 1A and 2A, in the power receiving circuit and a 2A fuse in the power circuit for the ultrasonic vibrator.

Turn OFF the power switch and check whether any of the fuses has burnt out. Refer to Subsection 4.2.2 for details.

- **Failure in Electric Circuits**

If there is no problem in the fuses and yet the ultrasonic oscillator remains inactive, the cause is a problem in the electric circuits. Consults with Yokogawa service.

4.2.2 Replacing Procedure for Fuse

(Check to see that the power switch is OFF before proceeding with the procedure.)

Using a flatblade screwdriver, remove the 1A fuse from the central one of the three fuse holders. If the fuse had burnt out, install the attached 1A fuse, and turn ON the power switch to actuate the ultrasonic oscillator.

If the fuse has not burnt out, install it as it was. Then check the right-hand adjacent 2A fuse (in the power receiving circuit) and the left-hand adjacent 2A fuse (in the power circuit for the ultrasonic vibrator), similarly.

5. Troubleshooting

If ultrasonic cleaning yields unfavorable results, make inspections first of all, referring to Chapter 4 in this manual. This chapter describes remedies for malfunctions of the ultrasonic oscillator.



Caution against Electric Shock

Even after the power switch is turned off, do not touch the electric circuits in the TUS400G ultrasonic oscillator. Some parts continue to be at high voltage for a while.

Consult Yokogawa for repairing the electric circuits.

5.1 Remedies for Troubles

If any trouble is encountered, promptly try to find the cause and remedy it.

5.1.1 Troubles and Possible Causes

Table 5.1 lists troubles that may be encountered and their causes.

Table 5.1 Troubles and Causes

Trouble	Possible cause
No cleaning effect by ultrasonic radiation	Drop in supply voltage (Refer to Subsection 5.1.2) Failure in the ultrasonic oscillator (Refer to Subsection 5.1.3) Defect in the ultrasonic vibrator (Refer to Subsection 5.1.3)
Frequent burnout of fuses	Abnormality in equipment (Refer to Subsection 5.1.3)
In-action pilot lamp lighting does not come back	Disconnection of the connecting wire for the ultrasonic vibrator (Refer to Subsection 5.1.4) Defect in the ultrasonic vibrator (Refer to Subsection 5.1.3)

5.1.2 Remedy for Supply Voltage Drop

If the voltage of the power supply to the ultrasonic oscillator drops, the ultrasonic power is also reduced. If the voltage remains below the allowable range for a long time, re-connect the oscillator to another power supply with less voltage fluctuation.

5.1.3 Remedy for failure in the ultrasonic oscillator or defect in the ultrasonic vibrator

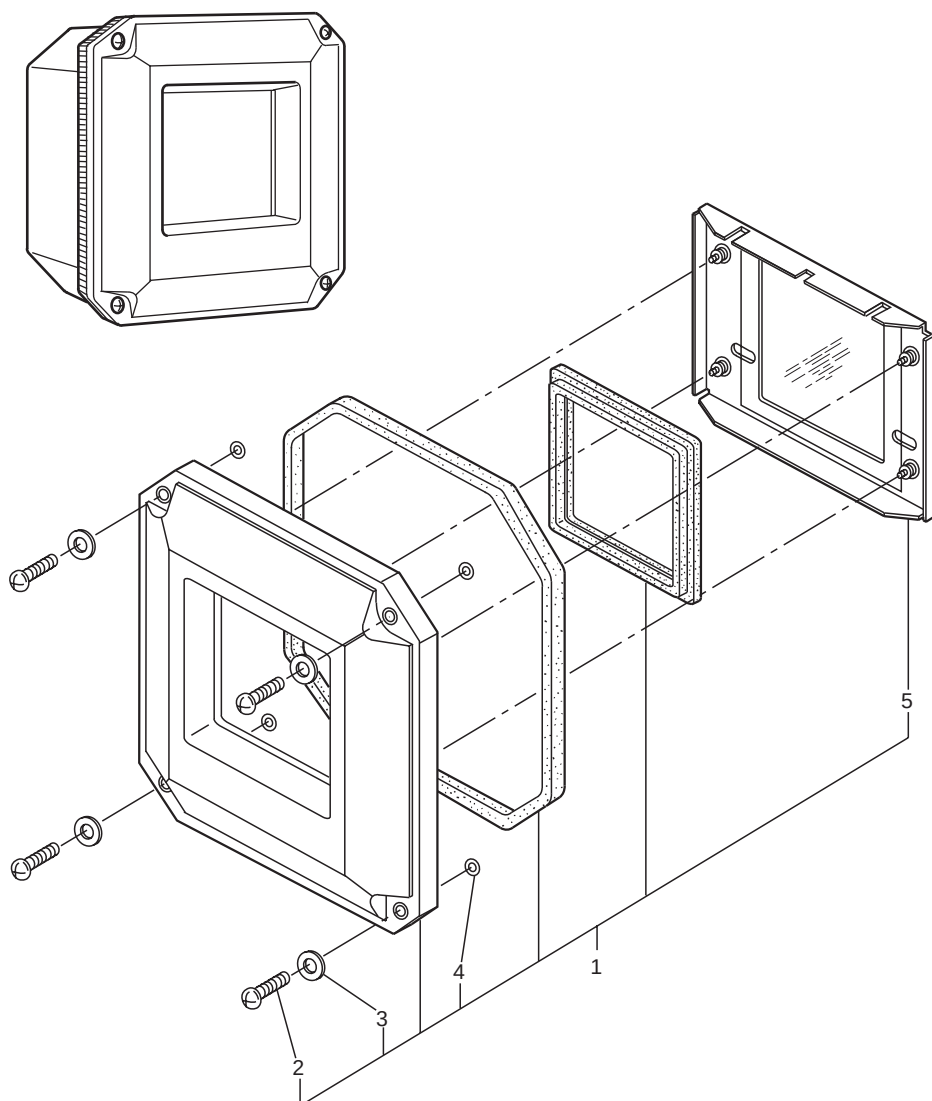
Checking and repairing ultrasonic oscillators and vibrators require extensive expertise and skills with electric circuits. If the devices do not operate normally, have them serviced by Yokogawa engineers.

5.1.4 Remedy for disconnection of the connecting cable for the ultrasonic transducer

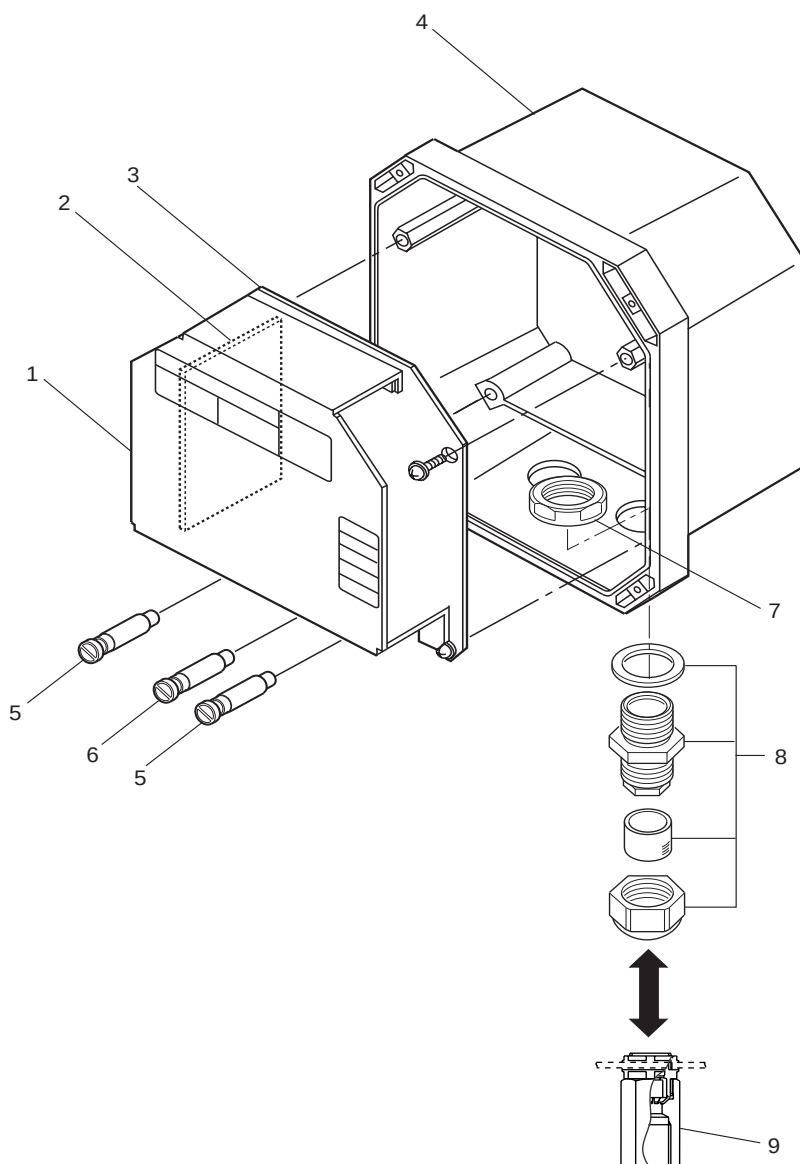
Repair or replace the cable.

Customer Maintenance Parts List

TUS400G Ultrasonic Oscillator for Turbidimeter



Item	Part No.	Qty	Description
1	- K9317AJ K9317BJ	1	Cover Assembly (Coating : Baked polyurethane resin) (Coating : Baked epoxy resin)
3	Y9500WU	4	Washer
4	Y9102XA	4	O-ring
5	K9311JN	1	Window Assembly

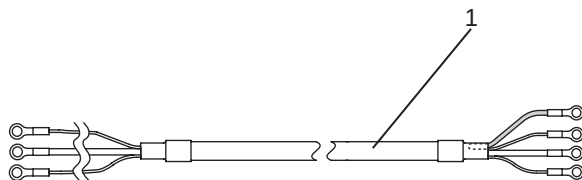


Item	Part No.	Qty	Description
1	K9317AB	1	Panel Assembly
2	K9317EB	1	Timer Board Assembly
3	-	1	Power Board Assembly
	K9317EP		(For 100 V AC Power Supply)
	K9317EQ		(For 110 V AC Power Supply)
	K9317ER		(For 115 V AC Power Supply)
	K9317ES		(For 200 V AC Power Supply)
	K9317ET		(For 220 V AC Power Supply)
	K9317EU		(For 240 V AC Power Supply)
4	-	1	Case Assembly
	K9317AQ		(Coating : Baked polyurethane resin)
	K9317BQ		(Coating : Baked epoxy resin)
5	A1111EF	2	Fuse (2 A)
6	A1109EF	1	Fuse (1 A)
7	L9811FK	2	Nut
8	L9811FT	2	Cable Gland
9	-	1	Adapter Assembly
	K9317AF		(For G1/2 screw; option code : /AFTG)
	K9317AG		(For 1/2NPT screw; option code : /ANSI)

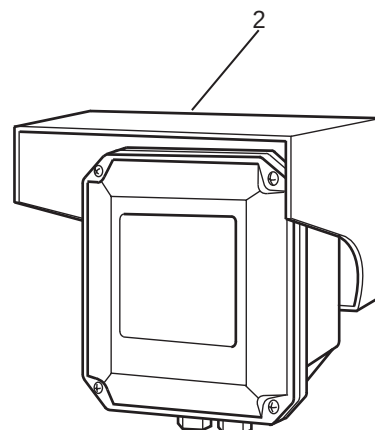
CABLE ASSEMBLY

(For TB700G, TB750G: Suffix code of -L1, -L2, -L3, or -L4)

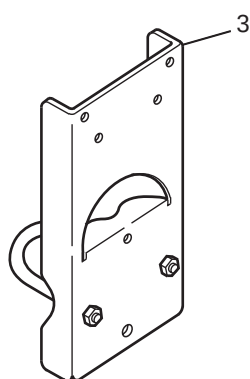
(For 8562 Turbidimeter: Suffix code of -05, -10, -15)



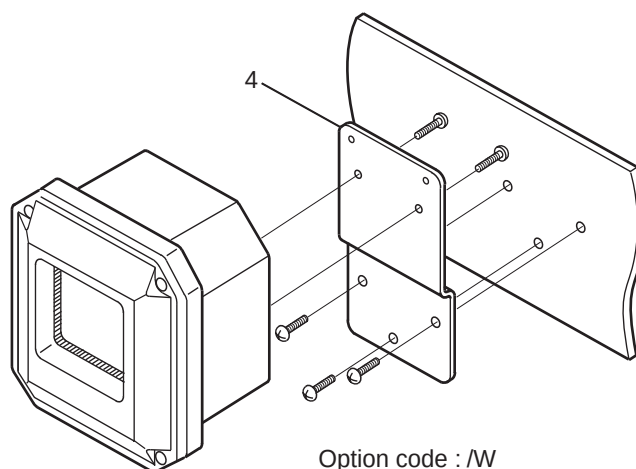
SUNSHADE HOOD(Optional code : /H)



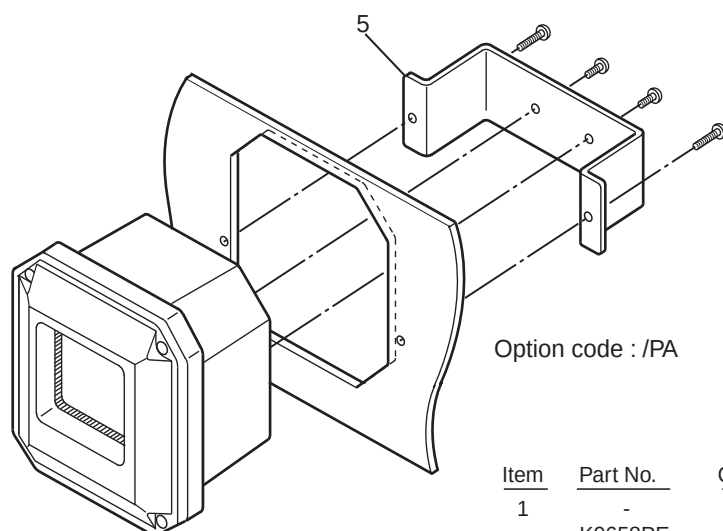
MOUNTING BRACKET



Option code : /PS



Option code : /W



Option code : /PA

Item	Part No.	Qty	Description
1	-	1	Cable Assembly
	K9658PE		(Cable length 1m, suffix code of -L1)
	K9658PF		(Cable length 5m, suffix code of -L2)
	K9658PG		(Cable length 10m, suffix code of -L3)
	K9658PH		(Cable length 15m, suffix code of -L4)
	K9317AL		(Cable length 5m, suffix code of -05)
	K9317AM		(Cable length 10m, suffix code of -10)
	K9317AN		(Cable length 15m, suffix code of -15)
2	K9311KG	1	Sunshade Hood
3	K99311KL	1	Pipe Mounting Bracket
4	K9149SB	1	Wall Mounting Bracket
5	K9311KA	1	Panel Mounting Bracket

Revision Information

- Title : Model TUS400G Ultrasonic Oscillator
- Manual No. : IM 19C1B4-01E

May 2015/6th Edition The reconsideration of contents, typographical errors corrected

3.2.2 The description in Outline of Adjusting Operation and Adjusting Procedure revised
Chapter 5 Note on the symbol for electric shock revised
5.1.1 The description in Table 5.1 revised
Subsections 5.1.3 and 5.1.4 added
Subsection 5.2 deleted

Mar. 2014/5th Edition Addition of "Australia, for Oceania areas (-RC)" and "For Korea (-KC)"

1.1 Addition of specifications, 1.2 Addition of Suffix Code, 1.3 Addition of the Noise filter assembly,
2.1.2 & 2.2.4 Postscript about -RC & -KC

Jul. 2012/4th Edition Page layout changed by InDesign

Revised and corrected all over (p.1-2, 8562 tubidimeter cables added to MS-code,
p.1-3, 8562 tubidimeter cables added to external dimensions, etc.)

Oct. 2007/3rd Edition IM style & Format renewed

Revised and corrected all over ("After-Sales Warranty" added, CMPL 19C01B04-01E revised to 4th
edition, etc.)

Feb. 1997/2nd Edition

Some error correction.

Apr. 1996/1st Edition

Newly published.

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